Chapter VI

Using a Semiotic Framework to Evaluate UML for the Development of Models of High Quality

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ABSTRACT

Many researchers have evaluated different parts of UML and have come up with suggestions for improvements to different parts of the language. This chapter looks at UML (version 1.3) as a whole, and contains an overview evaluation of UML and how it is supported in the modeling tool Rational Rose as a basis for creating models of high quality.

The evaluation is done using a general framework for understanding quality of models and modeling languages in the information systems field. The evaluation is based on both practical experiences and evaluations of UML and Rational Rose made by others.

Based on the evaluation, we conclude that, although being an improvement over its predecessors, UML still has many limitations and deficiencies. Also Rational Rose only partly supports the development of information system models of high quality, and provides too limited support for using different modeling techniques in concert within a larger methodological framework.

INTRODUCTION

According to Booch, Rumbaugh & Jacobson (1999), developing a model for an industrial strength software system before its construction is regarded increasingly as a necessary activity in information systems development. Good models are essential for communication among the members of project teams and to assure that it is possible to implement the system.
Modeling has been a cornerstone in many traditional software development methodologies for decades. The use of object-oriented modeling in analysis and design started to become popular in the late '80s, producing a large number of different languages and approaches. Lately, UML has taken a leading position in this area, partly through the standardization of the language within the Object Management Group (OMG).

In this chapter, I give an assessment of UML (version 1.3) and accompanying tools highlighting both the positive aspects and the areas where improvement is needed. I will first present the evaluation framework. I will then evaluate both the language quality of UML, and how this in combination with the modeling techniques found in one UML-tool, Rational Rose, can support the development of models of high quality. Evaluations of this kind usually only deal with language quality, but since this is only one of the factors influencing the creation of high-quality models (modeler characteristics, methodology and tools being other factors), I have included a tool evaluation to illustrate how the framework can be applied in a more general evaluation.

**BACKGROUND ON THE EVALUATION FRAMEWORK**

Most existing UML evaluations focus narrowly on what we call language quality, either by:

- evaluating UML relative to an existing approach (e.g., Henderson-Sellars, 1998; Paige & Ostroff, 1999), and highlighting those areas where the other approach is better than UML;
- looking upon detailed aspects of the language and presenting improvements for these areas (e.g., Hitz & Kappel, 1998);
- using a developed framework for assessing different aspects of language quality in a certain context (Hommes & van Reijswoud, 1999; Prasse, 1998) or only parts of language quality such as expressiveness.

Even those using a general evaluation framework look upon the language quality features as the goals to achieve. Contrary to this, Krogstie et. al. (Krogstie, 1995; Krogstie, Lindland & Sindre 1995; Krogstie & Sølvberg, 2000) have developed a framework for discussing the quality of models in general.

The framework;

- **distinguishes between quality goals and means to achieve these goals.** Language quality goals are one type of means, but means can also be related to modeling process, techniques and tools. Even if it can be argued from both activity theory and decision theory that the interrelationships between goals and means are being determined through the preference function of the modeler, we have found that most modeling techniques in practice primarily contribute to a specific model quality goal.
- **is closely linked to linguistic and semiotic theory.** In particular, the core of the framework including the discussion on syntax, semantics and pragmatics is parallel to the use of these terms in the semiotic theory of Morris. It is further based on the use of semiotic theory within the information systems field by Stamper (1998).
- **is based on a constructivistic world-view, recognizing that models are usually created as part of a dialogue between the participants involved in modeling.**

Further details on the framework can be found in Carlsen, Krogstie, Sølvberg and Lindland, (1997), Krogstie (1995, 1999b) and Krogstie and Sølvberg (2000), where several
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